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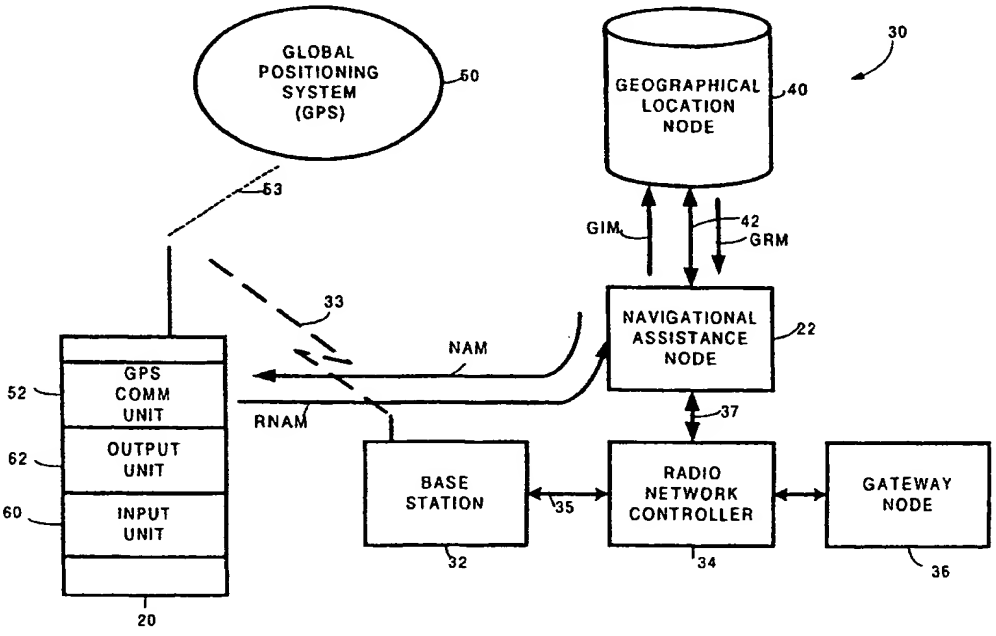
(54) Title: MOBILE TERMINAL NAVIGATIONAL ASSISTANCE SERVICE

(57) Abstract

In a telecommunications system, a mobile terminal (20) transmits a request for navigation assistance (RNAM) message over an air interface (33) to a mobile telecommunications network. In response to the request, a navigation assistance node (22) uses information related to a current geographical position of the mobile terminal to prepare a navigation assistance message (NAM) which is transmitted to the mobile terminal. The navigation assistance message includes information indicating a suggested navigation plan. The information related to the current geographical position of the mobile terminal, which is used by the navigational assistance node to prepare the navigational assistance message can be obtained in several ways, e.g., GPS coordinate data or parameter(s) of the mobile telecommunications network employed for servicing the mobile terminal. The navigational assistance node consults a geographical location database (40) to obtain e.g., direction and distance information, for preparing the navigation assistance message. The navigational assistance node (22) can be a node of a mobile telecommunications network or node of a fixed or wired telecommunications network which is connected through a gateway node or the like to a mobile telecommunications network. In one mode of the invention, the navigational assistance node provides a track back service which generates a navigational assistance message (NAM) for enabling the user of the mobile terminal to return to a former current geographical location.



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# MOBILE TERMINAL NAVIGATIONAL ASSISTANCE SERVICE

## BACKGROUND

### 1. FIELD OF THE INVENTION

The present invention pertains to navigational aids, and particularly to a navigational aid provided in conjunction with a telecommunications mobile terminal.

### 2. RELATED ART AND OTHER CONSIDERATIONS

A hazard of traveling is getting lost. Since ancient days maps of varying degree of detail have been utilized to afford assistance to travelers, whether the journey be near or far. In more recent years, sophisticated navigational systems such as the Global Positioning System (GPS) have been developed to provide locational information. GPS units, whether installed in craft (e.g., airplanes, ship, or other vehicles) or carried on the person, communicate with GPS satellites to provide GPS coordinate data to the user.

Some navigational aids provide travel assistance information using on-board data to develop a display or the like (e.g., a map) showing the traveler how to reach a desired (traveler-inputted) destination. Such aids can use GPS coordinate data or current location data otherwise inputted by the traveler.

Travel and mobility have also prompted innovation in the field of telecommunications, particularly the advent of mobile or cellular telecommunications systems. Using mobile terminals, such as mobile telephones, customers can roam without wire dependence and still remain in telephonic communication with other parties.

Some mobile telecommunications networks also use GPS coordinate data information for the purpose of assisting the network in handling a call from a mobile station. As those skilled in the art appreciate, location of a mobile terminal is important for deciding how connections therewith are to be handled and how resources of the mobile network are to be allocated. In this regard, see (for example) United States Patent 5,546,445 entitled "Cellular Telephone System That Uses Position Of A Mobile Unit To Make Call Management Decisions", and United States Patent 5,564,079 entitled "Method For Locating Mobile Stations In A Digital Telephone Network".

Mobile networks can also use GPS data to verify the location of a mobile terminal for commercial transactions purposes, as taught in United States Patent Application SN 09/047,533 entitled "Tele/Datacommunications Payment Method and Apparatus," incorporated herein by reference.

Currently, however, a mobile customer with a mobile terminal, lost or in need of navigational directions to a target geographical destination, has little sophisticated assistance from the telephone network itself. The mobile customer can place a call to a third party to inquire for and receive verbal instruction. But this assumes the existence and availability of a third person.

What is needed, therefore, and an object of the present invention, is automated handling by a telephone/computer network of a navigation assistance requested from a mobile terminal.

## BRIEF SUMMARY OF THE INVENTION

In a telecommunications system, a mobile terminal transmits a request for navigation assistance (RNAM) message over an air interface to a mobile telecommunications network. In response to the request, a navigation assistance node uses information related to a current geographical position of the mobile terminal to prepare a navigation assistance message (NAM) which is transmitted to the mobile

terminal. The navigation assistance message includes information indicating a suggested navigation plan.

The information related to the current geographical position of the mobile terminal, which is used by the navigational assistance node to prepare the navigational assistance message can be obtained in several ways. In some embodiments, the current geographical location of the mobile terminal is in the form of GPS coordinate data. In one mode of such embodiments, the mobile terminal recognizes (e.g., by special input key or key sequence) that the user of the mobile terminal is requesting assistance, in which case the mobile terminal itself can interrogate a GPS system to obtain the GPS coordinate data to send to the navigational assistance node. In another mode, the user of the mobile terminal places a call to the navigational assistance node, after which the navigational assistance node can interrogate the GPS system to obtain the GPS coordinate data. In other embodiments, the current geographical location of the mobile terminal is obtained from parameter of the mobile telecommunications network employed for servicing the mobile terminal.

The navigational assistance node consults a geographical location database to obtain e.g., direction and distance information, for preparing the navigation assistance message. The geographical location database can be a separate node or part of the navigational assistance node.

The navigational assistance node can be a node of a mobile telecommunications network. Alternatively, the navigational assistance node can be a node of a fixed or wired telecommunications network which is connected through a gateway node or the like to a mobile telecommunications network.

In one mode of the invention, the navigational assistance node provides a track back service which generates a navigational assistance message (NAM) for enabling the user of the mobile terminal to return to a former current geographical location. In connection with the track back service, the navigational assistance node has access to a track back database. The track back database stores one or more former current geographical locations of mobile terminal. The former current geographical locations of the mobile terminal can be stored at the track back database either automatically

(e.g., for all request for navigation assistance messages [RNAMs] generated by mobile terminal), or only selectively. The track back database can either be part of the navigational assistance node or a separate node.

## BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features, and advantages of the invention will be apparent from the following more particular description of preferred embodiments as illustrated in the accompanying drawings in which reference characters refer to the same parts throughout the various views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

Fig. 1 is a schematic view of a telecommunications system providing navigational assistance according to a first embodiment of the invention.

Fig. 1A is a schematic view of a telecommunications system providing navigational assistance according to a variation of the first embodiment of the invention.

Fig. 1B is a schematic view of a telecommunications system providing navigational assistance according to another variation of the first embodiment of the invention.

Fig. 2 is a schematic view of a telecommunications system providing navigational assistance according to a second embodiment of the invention.

Fig. 3 is a schematic view of a telecommunications system providing navigational assistance including a track back feature according to a third embodiment of the invention.

Fig. 4 is a diagrammatic view of an example format of a request for navigation assistance message (RNAM) according to a mode of the invention.

Fig. 5 is a schematic view of a mobile terminal according to an embodiment of the invention.

Fig. 5A is a schematic view of a mobile terminal according to another embodiment of the invention.

Fig. 6 is a diagrammatic view of an example format of a navigational assistance message (NAM) according to a mode of the invention.

Fig. 7 is a schematic view of an embodiment of a navigation assistance node according to the invention.

Fig. 7A is a schematic view of a navigation assistance node according to the embodiment of Fig. 1A.

Fig. 7B is a schematic view of a navigation assistance node according to the embodiment of Fig. 2.

Fig. 7C is a schematic view of a navigation assistance node according to the embodiment of Fig. 3.

Fig. 8 is a flowchart showing basic steps executed by a mobile terminal in connection with preparing a request for navigation assistance message.

Fig. 9 is a schematic view of a geographical location node according to an embodiment of the invention.

Fig. 10 is a schematic view illustrating a mode of operation of embodiments of the invention wherein a series of navigation messages are transmitted between a mobile terminal and a navigation assistance node.

## DETAILED DESCRIPTION OF THE DRAWINGS

In the following description, for purposes of explanation and not limitation, specific details are set forth such as particular architectures, interfaces, techniques, etc. in order to provide a thorough understanding of the present invention. However, it will be apparent to those skilled in the art that the present invention may be practiced in other embodiments that depart from these specific details. In other instances, detailed

descriptions of well known devices, circuits, and methods are omitted so as not to obscure the description of the present invention with unnecessary detail.

Fig. 1 shows a first embodiment of the invention in which a mobile terminal 20 requests navigational assistance from a navigational assistance node 22 of telecommunications network 30. In particular, mobile terminal 20 can send a request for navigation assistance message (RNAM) to navigational assistance node 22, and in response thereto receive a navigational assistance message (NAM). In the request for navigation assistance message (RNAM), mobile terminal 20 provides navigational assistance node 22 with a target geographical destination to which the user of mobile terminal 20 desires to travel. As explained hereinafter, the navigational assistance node 22 uses the current geographical position of mobile terminal 20 to prepare the navigational assistance message (NAM) to enable the user of mobile terminal 20 to travel to the target geographical destination. The navigational assistance message (NAM) includes information indicating a suggested navigation plan advising, e.g., a direction and distance for the mobile customer to travel in order to reach the target geographical destination. The navigational assistance node 22 can be part of a telephone network, a computer network, or a hybrid telephone/computer network.

The telecommunications network 30 shown in Fig. 1 is primarily a mobile or cellular telecommunications network, and as such includes at least one base station, such as base station 32. While telecommunications network 30 likely contains plural base stations, the particular base station 32 shown in Fig. 1 is capable of radio frequency communication over air interface 33 with mobile terminal 20. The structure of base stations such as base station 32 are well known, including the transmitter(s) and receiver(s) residing thereat and interfaces to other portions of telecommunications network 30.

The base station 32 particularly interfaces with a radio network controller (RNC) 34 over a landline link 35. In some contexts the radio network controller (RNC) 34 can also be called a base station controller. The radio network controller (RNC) 34 performs numerous processes related to coordination of base stations and the handling of mobile connections, including diversity operations, handoff and handover operations, etc. The radio network controller (RNC) 34 is typically connected to other RNCs and (for various purposes) to other nodes of telecommunications network 30. Various

activities of radio network controller (RNC) 34 are described, for example, in the following United States Patent applications, all of which are incorporated herein by reference: U.S. Patent Application SN 08/979,866 for "Multistage Diversity Handling for CDMA Mobile Telecommunications"; U.S. Patent Application SN 08/980,013 for "Diversity Handling Moveover for CDMA Mobile Telecommunications"; U.S. Patent Application SN 09/035,788 for "Telecommunications Inter-Exchange Congestion Control".

An RNC such as radio network controller (RNC) 34 can be connected to a gateway node such as gateway node 36. The gateway node 36 serves to connect the mobile telecommunications network to other networks, e.g., the fixed or wired telecommunications network.

In the particular embodiment illustrated in Fig. 1, the navigational assistance node 22 is shown as being connected to radio network controller (RNC) 34 via link 37. While such connection is one useful implementation, it should be understood that navigational assistance node 22 can be connected through other nodes, including through other RNCs. For example, a series of RNCs may exist between navigational assistance node 22 and the particular radio network controller (RNC) 34 to which base station 32 serving mobile terminal 20 is connected.

As explained subsequently, navigational assistance node 22 draws upon certain geographical location information. While the geographical location information necessary for navigational assistance node 22 to perform its function could reside at navigational assistance node 22 itself, in the illustrated embodiments such geographical location information is obtained from another node which is auxiliary or supplemental to navigational assistance node 22, particularly geographical location node 40. The geographical location node 40 is connected to navigational assistance node 22 by link 42.

Apart from telecommunications network 30, the embodiment of Fig. 1 includes a global positioning system (GPS) receiver/transmitter (e.g., GPS satellite), generally depicted as GPS system 50. To take advantage of GPS system 50, mobile terminal 20 is provided with a GPS communications unit 52, which is preferably on-board mobile

terminal 20. A communications link 53 exists between GPS system 50 and GPS communications unit 52 as shown by the broken line in Fig. 1.

The mobile terminal 20 is also provided with an input unit 60 and an output unit 62. The input unit 60 can take various forms, of which alphanumerical or numerical keypads are examples. Likewise, output unit 62 can comprise various devices, such as a display device (LED and LCD devices being common).

While Fig. 1 generally shows selected constituent units of mobile terminal 20, Fig. 5 shows connection of these and other units to a microprocessor 64 in an example embodiment of mobile station 20 which is a computer (e.g., laptop computer). Fig. 5 further shows that the example mobile terminal 20 can additionally include, among other things, various functional such as mobile termination entity (MT) 140; terminal adapter (TA) 142; terminal equipment 144; and a set 146 of applications. In essence, Fig. 5 shows that mobile termination entity (MT) 140 and terminal adapter (TA) 142 are cards situated in card slots in mobile station 20. Mobile termination entity (MT) 140, which is sometimes called the Mobile Equipment (ME), contains the radio transmitter/receiver TX/RX (with antenna 161) and communications control toward the network, e.g., the setup and release of radio connections, handover, etc. Terminal adapter (TA) 142 acts as an adaptation between mobile termination entity (MT) 140 and a set 146 of applications. The terminal adapter (TA) 142 is typically realized as a Modem implemented on a PCMCIA (Personal Computer Memory Card International Association) card, which is inserted in a card slot of mobile station 20. The terminal adapter (TA) 142 has a CPU 163 as well as a RAM 164 and a MT interface (I/F) 165. Terminal adapter (TA) 142 is connected to central processing unit (CPU) 64 by bus 102. Mobile termination entity (MT) is connected to MT interface 165 of terminal adapter (TA) 142 by a cable. Memories of mobile station 20, particularly read only memory (ROM) 104 and random access memory (RAM) 106 are also connected to central processing unit (CPU) 64 by bus 102. In RAM 106 are stored e.g., control logic 172, the set 46 of applications, and TCP/IP stack 108. Input device(s) 60 and output device(s) 62, are each connected through respective appropriate interfaces 120 and 122 to bus 102. A more detailed understanding of structure of a mobile terminal is ascertained from U.S. Patent Application SN 09/032,060 for "Multiple Access Categorization for Mobile Station", which is incorporated herein by reference.

In the embodiment of the invention shown in Fig. 5, GPS communications unit 52 resides on a separate GPS card at mobile station 20. The GPS communications unit 52 has its own antenna and, in like manner as phone card (MT) 140, is connected to MT interface (I/F) 165. In an alternate embodiment shown in Fig. 5A, GPS communications unit 52A is integrated into phone card (MT) 140. In the alternate embodiment of Fig. 5A, GPS communications unit 52A utilizes the same antenna 161 as phone card (MT) 140. In an unillustrated variation of this embodiment, GPS communications unit 52A has a separate antenna.

In the situation shown in Fig. 1, when lost or seeking navigational assistance, the user of mobile terminal 20 operates input unit 60 in accordance with a predetermined convention to generate a request for navigation assistance message (RNAM). For example, the user may operate a predetermined special key, or a predetermined sequence of conventional keys, to indicate that a request for navigation assistance message (RNAM) is to be generated.

Fig. 8 shows basic steps executed by microprocessor 64 of mobile terminal 20 of Fig. 1 in connection with preparation of a request for navigation assistance message (RNAM), beginning (at step 8-1) with recognition of a user request for generation of a request for navigation assistance message (RNAM). When such a request is recognized, at step 8-2 microprocessor 64 directs GPS communications unit 52 of mobile terminal 20 to interrogate GPS system 50 in order to obtain GPS coordinate data of the current geographical location of mobile terminal 20. When microprocessor 64 determines that GPS communications unit 52 has obtained the GPS coordinate data (e.g., by interrupt or polling), at step 8-4 the microprocessor 64 generates a request or prompt for the user to input information indicative of the target geographical destination. The prompt of step 8-4 can be provided on output unit 62, for example, inviting the user to use input unit 60 to input such target geographical destination. The microprocessor 64 checks at step 8-5 to determine when the user has completed entry of the target geographical destination. Upon detecting such completion (e.g., by a special complete key or the like), at step 8-6 the microprocessor 64 prepares the request for navigation assistance message (RNAM) and sends the request for navigation assistance message (RNAM) [e.g., via an interface in mobile terminal 20] to telecommunications network 30 over air interface 33.

Fig. 4 shows an example format of portions of a request for navigation assistance message (RNAM) sent by mobile terminal 20 to telecommunications network 30. The request for navigation assistance message (RNAM) of Fig. 4 includes a header 4-1 which is used by telecommunications network 30 for making a connection. The header 4-1 includes information sufficient for identifying the mobile terminal 20, which information is generally depicted as field 4-2. In addition, the request for navigation assistance message (RNAM) includes a message type code field 4-3 which, upon the sending of the request for navigation assistance message (RNAM), indicates a request for navigation assistance message (RNAM). Further included in the request for navigation assistance message (RNAM) is a target geographical destination field 4-4, which contains information based on the input acquired in response to step 8-4 (see Fig. 8). Yet further included is a current geographical location field 4-5, which contains the GPS coordinate data information obtained at step 8-3 (see Fig. 8).

Information carried in the request for navigation assistance message (RNAM) is sent to navigational assistance node 22 as indicated by arrow RNAM in Fig. 1. In particular, information in the request for navigation assistance message (RNAM) is sent over air interface 33 to base station 32. The base station 32 prepares a derivative message related to the request for navigation assistance message (RNAM) for transmission over landline link 35 to radio network controller (RNC) 34. Similarly, the radio network controller (RNC) 34 sends its RNAM-related message over link 37 to navigational assistance node 22. Thus, it should be understood that the request for navigation assistance message (RNAM) as generated by mobile terminal 20 is not purely transmitted to navigational assistance node 22, but in effect the important information thereof is transmitted to navigational assistance node 22 for which reason the arrow labeled request for navigation assistance message (RNAM) is employed in Fig. 1.

Fig. 7 shows basic components of navigational assistance node 22, and particularly its microprocessor 22-10 which communicates via telecommunications interface unit 22-12 with telecommunications network 30 (e.g., over link 37 to radio network controller (RNC) 34) and which communicates via interface 22-14 over link 42 with geographical location node 40. In handling a request for navigation assistance message (RNAM), the microprocessor 22-10 performs several functions as represented

by blocks 22-10A through 22-10C (see Fig. 7). As first functionality 22-10A, microprocessor 22-10 analyzes the request for navigation assistance message (RNAM) to ascertain both the current geographical location of mobile terminal 20 and the target geographical destination. These parameters are passed to functionality 22-10B, which prepares a message for interrogating geographical location node 40. The geographical interrogation message (GIM) is transmitted to geographical location node 40 (via interface 22-14) as indicated by the arrow labeled GIM in Fig. 1. The geographical location node 40 prepares and transmits to navigational assistance node 22 a geographical response message (GRM), as indicated by the arrow labeled GRM in Fig. 1. The functionality 22-10C of microprocessor 22-10 uses the contents of the geographical response message (GRM) to prepare a navigation assistance message (NAM). The navigational assistance message (NAM) is transmitted via telecommunications interface unit 22-12 to telecommunications network 30, with information of the navigational assistance message (NAM) being sent over air interface 33 to mobile terminal 20. The transmission of information of the navigational assistance message (NAM) from navigational assistance node 22 to mobile terminal 20 is depicted by arrow NAM in Fig. 1.

An illustrative format of an example navigational assistance message (NAM) is shown in Fig. 6. The navigational assistance message (NAM) of Fig. 6 includes a header 6-1, which includes information sufficient for identifying the particular mobile (i.e., mobile terminal 20) to which the navigational assistance message (NAM) is addressed, as indicated by MT ID field 6-2. In addition, the navigational assistance message (NAM) includes message type field 6-3 and one or more fields 6-4 which contain information indicating a suggested navigation plan. Fig. 6A shows a navigational assistance message (NAM) in which field(s) 6-4 can be subdivided into a directionality information field 6-4A and a distance field 6-4B. In this regard, field 6-4A can contain information advising in what direction the user of mobile terminal 20 is to travel; the information in field 6-4B can contain information advising the distance to travel (e.g., the distance to target geographical destination).

It should be understood that the navigational assistance message (NAM) of Fig. 6 and Fig. 6B are merely illustrative of the types of information transmitted from navigational assistance node 22 to mobile terminal 20. Moreover, it should be

understood that the navigational assistance message (NAM), like the request for navigation assistance message (RNAM), is repacketized and subject to differing protocols as it travels over the various links and air interface 33 between navigational assistance node 22 and mobile terminal 20.

Upon receipt of the navigational assistance message (NAM), the microprocessor 64 of mobile terminal 20 works through a driver or interface for output unit 62 in order to provide the navigation assistance information contained in navigational assistance message (NAM) to the user of mobile terminal 20.

Fig. 1A shows a variation of the embodiment of Fig. 1 in which the navigational assistance message (NAM) takes the form of a call placed by the user of mobile station 20 to navigational assistance node 22A in order to receive navigation assistance. In the embodiment of Fig. 1A, the user enters a directory number (which can be a toll number) for navigational assistance node 22A. Fig. 1A depicts by arrow CALL the call placed to navigational assistance node 22A for navigation assistance by the user of mobile station 20. The telecommunications network 30 makes a connection between mobile station 20 and navigational assistance node 22A in conventional manner.

Fig. 7A shows that navigational assistance node 22A differs from navigational assistance node 22 of Fig. 7 in that microprocessor 22A-10 has a target prompt generator interface functionality 22A-10D (for interface with prompt generator 22A-16) and a GPS interrogation functionality 22A-10E. The prompt generator 22A-16 is employed to create a prompt message (shown as arrow PROMPT FOR TARGET in Fig. 1A) during the connection between mobile station 20 and navigational assistance node 22A. Upon receipt of the prompt message, microprocessor 64 of mobile station 20 provides a prompt to the user to enter an indication of the target. Upon entry of the target, a responsive message shown by arrow TARGET is sent from mobile station 20 to navigational assistance node 22A.

It should be understood that the prompt message generated by 22A-16 of navigational assistance node 22A can be of several types. For example, the PROMPT FOR TARGET message can be an audible (e.g., prerecorded) message placed as part of the connection. Alternatively, the PROMPT FOR TARGET message can be data which

causes microprocessor 64 of mobile station 20 to generate an alphabetical prompt (e.g. on output unit 62) readable by the user, such as "ENTER TARGET DESITNATION".

Similarly, in response to the PROMPT FOR TARGET message, the user of mobile station 20 can respond in one of several ways. For example, the user can audibly utter the target if the navigational assistance node 22A has voice recognition and/or voice to data conversion capabilities. Alternatively, the user of mobile station 20 can employ input unit 60 (which can be an alphanumeric keypad) for entering information indicative of the target.

The navigational assistance node 22A must also receive the current geographical location of mobile station 20, for which reason the GPS interrogation functionality 22A-10E prepares and transmits a GPS interrogate message to mobile station 20 as part of the connection. Such GPS interrogate message is shown by arrow GPSI in Fig. 1A. The GPRS interrogate message is processed by microprocessor 64, and results in the microprocessor 64 performing steps comparable to steps 8-2 and 8-3 of Fig. 8. That is, microprocessor 64 causes GPS communications unit 52 to interrogate GPS system 50 and receives GPS coordinate data from GPS system 50. The microprocessor 64 then prepares a GPS coordinate data message (as indicated by arrow GPSO) in Fig. 1A) for transmission to navigational assistance node 22A. Upon receipt of both the target geographical location and current geographical location (which need not be received or prompted in any particular order), microprocessor 22A-10 performs the remainder of its function in like manner as described with reference to Fig. 1B for preparing and transmitting a navigational assistance message (NAM) to mobile station 20.

In the foregoing a connection switched node was assumed in which messages are sent between mobile station 20 and navigational assistance node 22A during the duration of an established connection. As an alternative, in a packet switched node the messages may be sent as generated in accordance with typical packet switched technology.

The above discussed embodiments presumed navigational assistance node 22 and navigational assistance node 22A to comprise part of a mobile telecommunications network. Fig. 1B, on the other hand, shows an embodiment in which a navigation assistance node 22B is part of a fixed telecommunications network 30B which is

connected via gateway node 36 to mobile telecommunications network 30. In the embodiment of Fig. 1B, the routing of the request for navigation assistance message (RNAM) and navigational assistance message (NAM) is through gateway node 36 and, if necessary, one or more switches of fixed telecommunications network 30B for reaching navigation assistance node 22B. The basic functions of navigation assistance node 22B, and its connection and operation to fixed-network database 40B, are comparable to those described for previous embodiments.

The embodiments thus far described employ GPS coordinate data as the current geographical location. Fig. 2, by contrast, features an embodiment in which the current geographical location is obtained from mobile telecommunications network 30, and particularly parameters of telecommunications network 30 utilized for serving mobile station 20. To this end, navigation assistance node 22(2) of Fig. 2, situated in like manner as navigational assistance node 22 of Fig. 1, includes a functionally 22(2)-10C in its microprocessor 22(2)-10 [see Fig. 7B]. As shown in Fig. 7B, functionally 22(2)-10C generates a message for interrogating the mobile telecommunications network for parameters indicative of current geographical location. The parameter interrogation message is depicted by arrow CURPOSPARAMINT in Fig. 2. The parameter interrogation message is transmitted from navigation assistance node 22(2) to radio network controller 34.

The one or more parameters sought by the parameter interrogation message (depicted by arrow CURPOSPARAMINT in Fig. 2) are those which indicate the position of mobile station 20. The parameters sought and obtained by the parameter interrogation message can be of various types, including (for example) geographical coordinates or a range of geographical coordinates determined by the mobile telecommunications network as being descriptive of the current geographical position of the mobile unit. The parameter(s), e.g., coordinates, can reflect the position of mobile station 20 with respect to the geographical location of a pertinent station, e.g., a base station 32, of the mobile telecommunications network, or with respect to a more generalized geographical system. Time can be used as a parameter for calculating a distance between the mobile station 20 and the base station 32, i.e., the time for the radio signal to traverse the distance from mobile station 20 to base station 32. With respect to mobile station 20, the radio network controller 34 can be periodically advised

of the geographical location parameters, e.g., by signaling from base station 32 over link 35. The precision of the positioning depends upon, e.g., the refinement of the coordinate system and the particular logic employed.

Upon receipt of the parameters indicative of current geographical location, the navigation assistance node 22(2) performs the interrogation of geographical location node 40 and preparation/transmission of the navigational assistance message (NAM) in similar manner as described in connection with the previous embodiments.

Fig. 3 shows an embodiment wherein navigational assistance node 22(3) provides a track back service. In accordance with the track back service, navigational assistance node 22(3) generates a navigational assistance message (NAM) which enables the user of mobile station 20 to return to a former current geographical location. In accordance with the embodiments previously discussed, if the user were located at a hotel (the user's current geographical location) and desired to go to an office building (the user's target geographical location), the navigational assistance message (NAM) would provide directions for the user to reach the office building. The track back service of the embodiment of Fig. 3 further enables the user, after completing a meeting or the like at the office building, to inquire of navigational assistance node 22(3) how to return to the hotel (i.e., the former current geographical location).

As shown in Fig. 3, navigational assistance node 22(3) has access to a track back database 45 over link 46. The track back database 45 stores, under direction of the navigational assistance node 22(3), one or more former current geographical locations of mobile station 20. The former current geographical locations of mobile station 20 can be stored at the track back database 45 either automatically (e.g., for all request for navigation assistance messages [RNAMs] generated by mobile station 20), or only selectively. In one version of implementation, track back database 45 stores only the most recently entered current geographical location in track back database 45 for future use in connection with the track back option. In another version of implementation, track back database 45 stores a set of former current geographical location records for each user.

The track back database 45 can either be part of navigational assistance node 22(3), or a separate node as shown in Fig. 3. In either case, the microprocessor 22(3)-

10 of navigational assistance node 22(3) includes a track back logic 22(3)-10H as shown in Fig. 7C for preparing track back-related messages and handling track back responses from the user, as well as for accessing and retrieving records from track back database 45.

The operation of the embodiment of Fig. 3 is similar to that of Fig. 1A, with the exception of various additional messages sent between mobile station 20 and navigational assistance node 22(3) under supervision of the track back logic 22(3)-10H. For example, in lieu of the PROMPT FOR TARGET message of Fig. 1A, the navigational assistance node 22(3) of Fig. 3 sends a TRACK BACK PROMPT when a call is placed to navigational assistance node 22(3). The TRACK BACK PROMPT simply inquires whether the user of mobile station 20 desires to use the track back service. The user responds with either a YES or NO answer, as indicated by the TRACK BACK RESPONSE message shown in Fig. 3. If the TRACK BACK RESPONSE message has a negative content, navigational assistance node 22(3) sends a TARGET PROMPT message and subsequent messages much as in the same manner as depicted in Fig. 1A.

Fig. 3 shows further messages sent between navigational assistance node 22(3) and mobile station 20 in the event that the response in the TRACK BACK RESPONSE message is affirmative. A first of these messages is the TRACK BACK MENU message sent from navigational assistance node 22(3) and which identifies one or more potential former current geographical locations to which the user of mobile station 20 may wish to return. The TRACK BACK MENU message results in the user of mobile station 20 being provided with a list, either audible or visual, of the candidate former current geographical locations stored in track back database 45 for the user. The TRACK BACK MENU message is prepared by the track back logic 22(3)-10H after track back logic 22(3)-10H obtains the menu content from track back database 45. In this regard, microprocessor 22(3)-10 of navigational assistance node 22(3) uses the track back logic 22(3)-10H to prepare a FETCH message for obtaining one or more records of former current geographical locations for the user from track back database 45. The track back database 45 responds to the FETCH message with a RETURN message. The RETURN message includes one or more former current geographical locations for the user of mobile station 20. The track back logic 22(3)-10H then

prepares the TRACK BACK MENU message for mobile station 20 using the contents of the RETURN message. The user of mobile station 20 responds to the TRACK BACK MENU message with input which generates a MENU RESPONSE message. The MENU RESPONSE message contains, for example, an indication of which of the plural potential former current geographical locations the user has selected.

The track back service is shown in Fig. 3 as working in conjunction with the GPS technique for obtaining the current geographical location of the user of mobile station 20. For this reason, the GPS-related messages similar to those of Fig. 1A are also shown in Fig. 3. However, it should be understood that the track back service can also be utilized in connection with other embodiments, such as the non-GPS embodiment of Fig. 2, for example.

With the embodiments described thus far it has primarily been demonstrated a mode of operation wherein mobile station 20 generates one request for navigation assistance (RNAM) message over an air interface to a mobile telecommunications network, and ultimately to navigation assistance mode 22, with navigation assistance node 22 using information related to a current geographical position of the mobile terminal to prepare a navigation assistance message (NAM) which is transmitted to the mobile terminal in the form of a suggested navigation plan. In such mode of operation, the suggested navigation plan may be a comprehensive list of directions to reach an ultimate destination. That is, the suggested navigation plan may contain a plurality of step-by-step instructions, with all steps provided in the navigation assistance message (NAM).

Fig. 10 illustrates how any of the previously described embodiments can function in another mode. In the mode of Fig. 10, when the navigation assistance feature of the present invention is activated at mobile station 20 (e.g., using input unit 60), the microprocessor 64 prepares a series of request for navigation assistance (RNAM) messages which are transmitted to navigation assistance node 22. For each request for navigation assistance (RNAM) message, navigation assistance node 22 responds with a navigation assistance message (NAM). Thus, a series of request for navigation assistance (RNAM) messages and a responsive series of navigation assistance messages (NAM) are generated in the mode of Fig. 10.

Fig. 10 shows mobile station 20 at each of four intermediate geographical positions in route to target geographical destination D. In the geographical topology reflected in Fig. 10, the user of mobile station 20 is traveling along street S1 toward the target geographical destination D. In order to reach target geographical destination D, the user will have to continue along street S1, passing streets S2 and S3, and then taking a right turn onto street S3 in order to reach the target geographical destination D.

In Fig. 10 mobile station 20 acquires a subscript indicative of the four intermediate geographical positions in route to the target geographical destination D. That is, at a first intermediate geographical the mobile station is depicted as mobile station $20_1$, at a second intermediate geographical the mobile station is depicted as mobile station $20_2$, and so forth as mobile station 20 travels toward target geographical destination D. Fig. 10 also shows (by appropriate subscripts) the generation of the messages RNAM and NAM for each of the four intermediate geographical positions. Although Fig. 10, for sake of simplicity, shows the RNAM and NAM messages as being transmitted between the mobile station (at its various intermediate geographical positions) and navigation assistance node 22, it should be understood that the RNAM messages are routed to navigation assistance node 22 through base station 32 and radio network controller 34 in the manner shown, e.g., in Fig. 1, and that the NAM messages are routed to mobile station 20 from through radio network controller 34 and base station 32.

In one particular implementation of Fig. 10, the request for navigation assistance (RNAM) messages are generated by mobile station 20 at predetermined time intervals. Since the mobile station 20 may not be traveling at a constant rate of speed (e.g., may slow down or stop), the intermediate geographical positions are not necessarily at equal geographical intervals. In other implementations, the request for navigation assistance (RNAM) messages may be generated by mobile station 20 in other manners.

Thus, in the mode of Fig. 10, the suggested navigation plan takes the form of series of navigation assistance messages (NAM). In this mode, each navigation assistance messages (NAM) can provide an incremental amount of information, or can (more preferably) provide the entire suggested navigation plan from to the target geographical destination D from the intermediate geographical position from which its corresponding request for navigation assistance (RNAM) message issued.

As shown in Fig. 9, the geographical location node 40 has an interface 40-10 through which geographical location node 40 is connected by link 42 to navigational assistance node 22. Interface 40-10 decodes and forwards to pathfinder logic 40-20 the geographical interrogation messages (GIMs) transmitted to geographical location node 40 from navigational assistance node 22, and also prepares the geographical response messages (GRMs) returned by geographical location node 40 to navigational assistance node 22. The pathfinder logic 40-20 consults the database of geographical data 40-30 in order to determine a path between the current geographical location and the target geographical location. The database of geographical data 40-30 contains a mapping between addresses and geographical coordinates.

It should be understood that output unit 62 can take various forms, including (for example) a display device (such as a liquid crystal display or LED display); an audible tone generator; a compass; and a printer (for generating hardcopy human readable media). Moreover, it should be understood that output unit 62 can comprise two or more output devices, e.g., a combination of display and audible output. In the case of output unit 62 being a display device, the navigational assistance message (NAM) can result in a map being displayed on output unit 62. The map can include depictions both of the current geographical location and the target geographical location.

While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiment, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

## WHAT IS CLAIMED IS:

1. A telecommunications system comprising:

a mobile terminal which transmits a request for navigation assistance message over an air interface to a mobile telecommunications network;

a navigation assistance node, included in or connected to the mobile telecommunications node, which, in response to the request for navigation assistance message, uses information related to a current geographical position of the mobile terminal to prepare a navigation assistance message which is transmitted to the mobile terminal, the navigation assistance message including information indicating a suggested navigation plan.

2. A telecommunications system of claim 1 wherein the information related to the current geographical position of the mobile terminal is GPS information.

3. A telecommunications system of claim 2, wherein the mobile terminal includes a GPS communication unit which provides the mobile terminal with GPS information related to the current geographical position of the mobile terminal, and wherein the GPS information is transmitted over the air interface to the navigation assistance node.

4. A telecommunications system of claim 1, wherein the information related to the current geographical position of the mobile terminal is obtained from a parameter of the mobile telecommunications network employed for servicing the mobile terminal.

5. A telecommunications system of claim 4, wherein the parameter is one of a geographical coordinate and a parameter related to time of signal travel from the mobile terminal to a station of the telecommunications system.

6. A telecommunications system of claim 1, further comprising a geographical location database which is consulted by the navigation assistance node to prepare the navigation assistance message.

7. A telecommunications system of claim 1, wherein the navigation assistance node provides a series of navigation assistance messages as the mobile terminal is in locomotion.

8. A telecommunications system of claim 1, wherein the suggested navigation plan includes an indication of a suggested direction to a target destination, the target destination having been included in the request for navigation assistance message.

9. A telecommunications system of claim 8, wherein the mobile terminal includes an output display, and wherein the indication of the suggested direction is visibly displayed on the output display.

10. A telecommunications system of claim 9, wherein a map is generated on the output display.

11. A telecommunications system of claim 9, wherein the suggested navigation plan further includes a distance to the target destination, and wherein the distance to the target destination is visibly displayed on the output display.

12. A telecommunications system of claim 8, wherein the mobile terminal includes an output device which generates human readable media, and wherein the indication of the suggested direction is outputted to the human readable media.

13. A telecommunications system of claim 12, wherein the output device is a printer.

14. A telecommunications system of claim 8, wherein the mobile terminal includes a compass, and wherein the compass is responsive to the indication of the suggested direction.

15. A telecommunications system of claim 8, wherein the indication of the suggested direction is provided as one or more tones generated at the mobile terminal.

16. A telecommunications system of claim 1, wherein the navigation assistance message is prepared by the navigation assistance node for audible reproduction at the mobile terminal.

17. A telecommunications system of claim 1, wherein the navigation assistance node retains in a memory the information related to the current geographical position of the mobile terminal as former current geographical location after the navigation assistance message is transmitted to the mobile terminal.

18. A telecommunications system of claim 17, wherein the navigation node generates, in response to an option selected at the mobile terminal, a navigational assistance message wherein the target geographical location is the former current geographical location.

19. A telecommunications system of claim 1, wherein the navigation assistance message includes information for returning to a former geographical position of the mobile terminal.

20. A method of operating a telecommunications system, the method comprising:

receiving, over an air interface from a mobile terminal, a request for navigation assistance message, and in response thereto

preparing a navigation assistance message which is transmitted to the mobile terminal, the navigation assistance message including information indicating a suggested navigation plan relative to a current geographical position of the mobile terminal.

21. The method of claim 20, further comprising using GPS information as to ascertain the current geographical position of the mobile terminal.

22. The method of claim 21, further comprising transmitting the GPS information over the air interface to the navigation assistance node.

23. of claim 20, further comprising obtaining the current geographical position of the mobile terminal from a parameter of the mobile telecommunications network employed for servicing the mobile terminal.

24. of claim 23, wherein the parameter is one of a geographical coordinate and a parameter related to time of signal travel from the mobile terminal to a station of the telecommunications system.

25. of claim 20, further comprising consulting a geographical location database to prepare the navigation assistance message.

26. of claim 20, further comprising the navigation assistance node providing a series of navigation assistance messages as the mobile terminal is in locomotion.

27. of claim 20, further comprising including in the suggested navigation plan an indication of a suggested direction to a target destination, the target destination having been included in the request for navigation assistance message.

28. The method of claim 27, further comprising visibly displaying the indication of the suggested direction on an output device.

29. The method of claim 28, further comprising generating a map on the output device.

30. The method of claim 29, wherein the suggested navigation plan further includes a distance to the target destination, and wherein the method further includes visibly displaying the distance to the target destination on the output device.

31. The method of claim 27, further including outputting the indication of the suggested direction is outputted to the human readable media.

32. The method of claim 27, further comprising driving a compass to provide the indication of the suggested direction.

33. The method of claim 27, further comprising providing the indication of the suggested direction as one or more tones generated at the mobile terminal.

34. The method of claim 20, further comprising preparing the navigation assistance message for audible reproduction at the mobile terminal.

35. The method of claim 20, further comprising retaining in a memory the information related to the current geographical position of the mobile terminal as former current geographical location after the navigation assistance message is transmitted to the mobile terminal.

36. The method of claim 35, further comprising generating, in response to an option selected at the mobile terminal, a navigational assistance message wherein the target geographical location is the former current geographical location.

37. The method of claim 20, further comprising including in the navigation assistance message information for returning to a former geographical position of the mobile terminal.

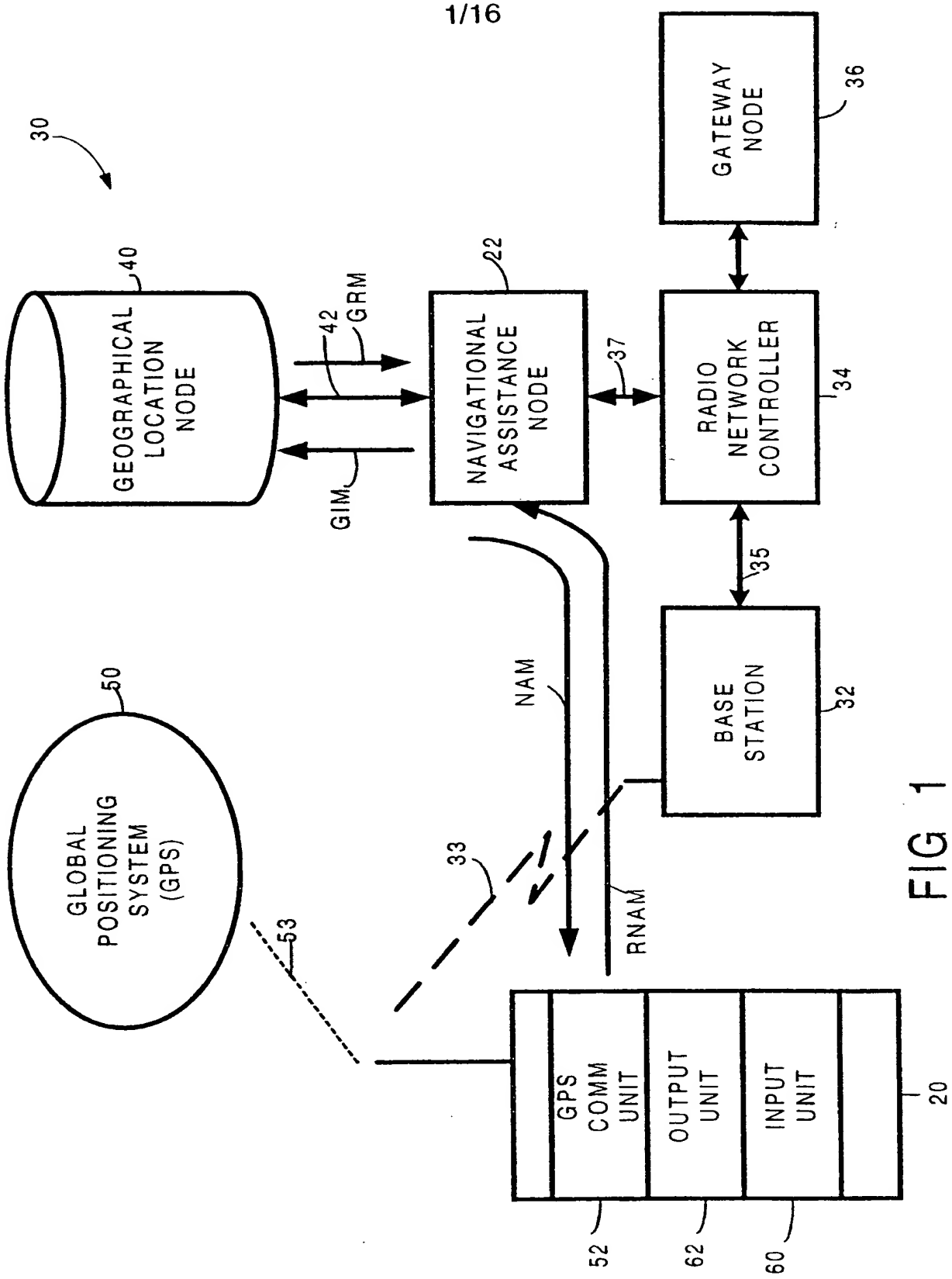

30
GATEWAY NODE
36
GEOGRAPHICAL LOCATION NODE
40
42
GRM
GIM
NAVIGATIONAL ASSISTANCE NODE
22
37
RADIO NETWORK CONTROLLER
34
35
BASE STATION
32
NAM
RNAM
33
GLOBAL POSITIONING SYSTEM (GPS)
50
53
GPS COMM UNIT
OUTPUT UNIT
INPUT UNIT
20
52
62
60

FIG 1

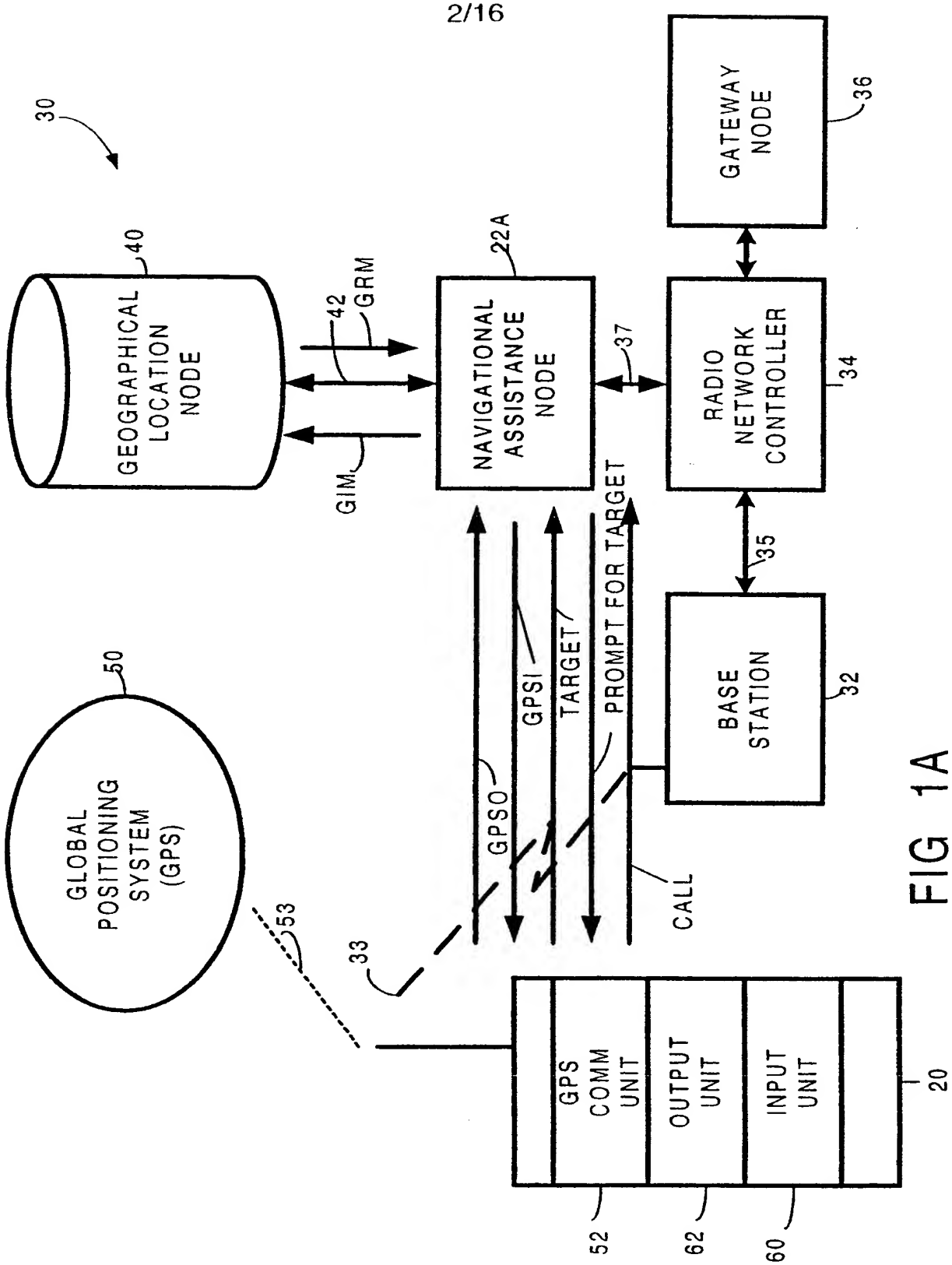



FIG 1A

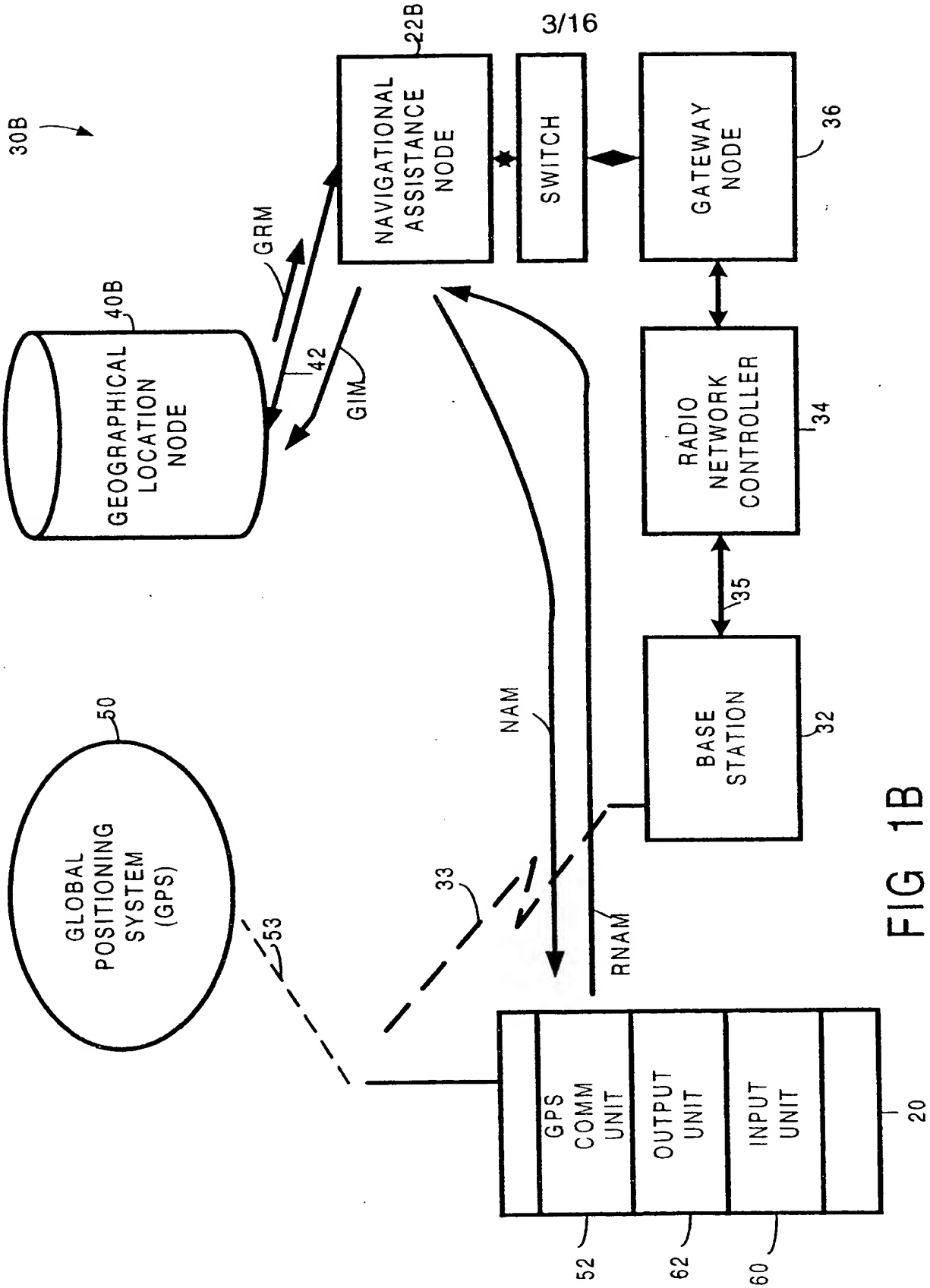

30B
NAVIGATIONAL ASSISTANCE NODE
22B
SWITCH
GATEWAY NODE
36
GRM
GEOGRAPHICAL LOCATION NODE
40B
42
GIM
RADIO NETWORK CONTROLLER
34
35
BASE STATION
32
NAM
50
GLOBAL POSITIONING SYSTEM (GPS)
53
33
RNAM
GPS COMM UNIT
OUTPUT UNIT
INPUT UNIT
20
52
62
60

FIG 1B

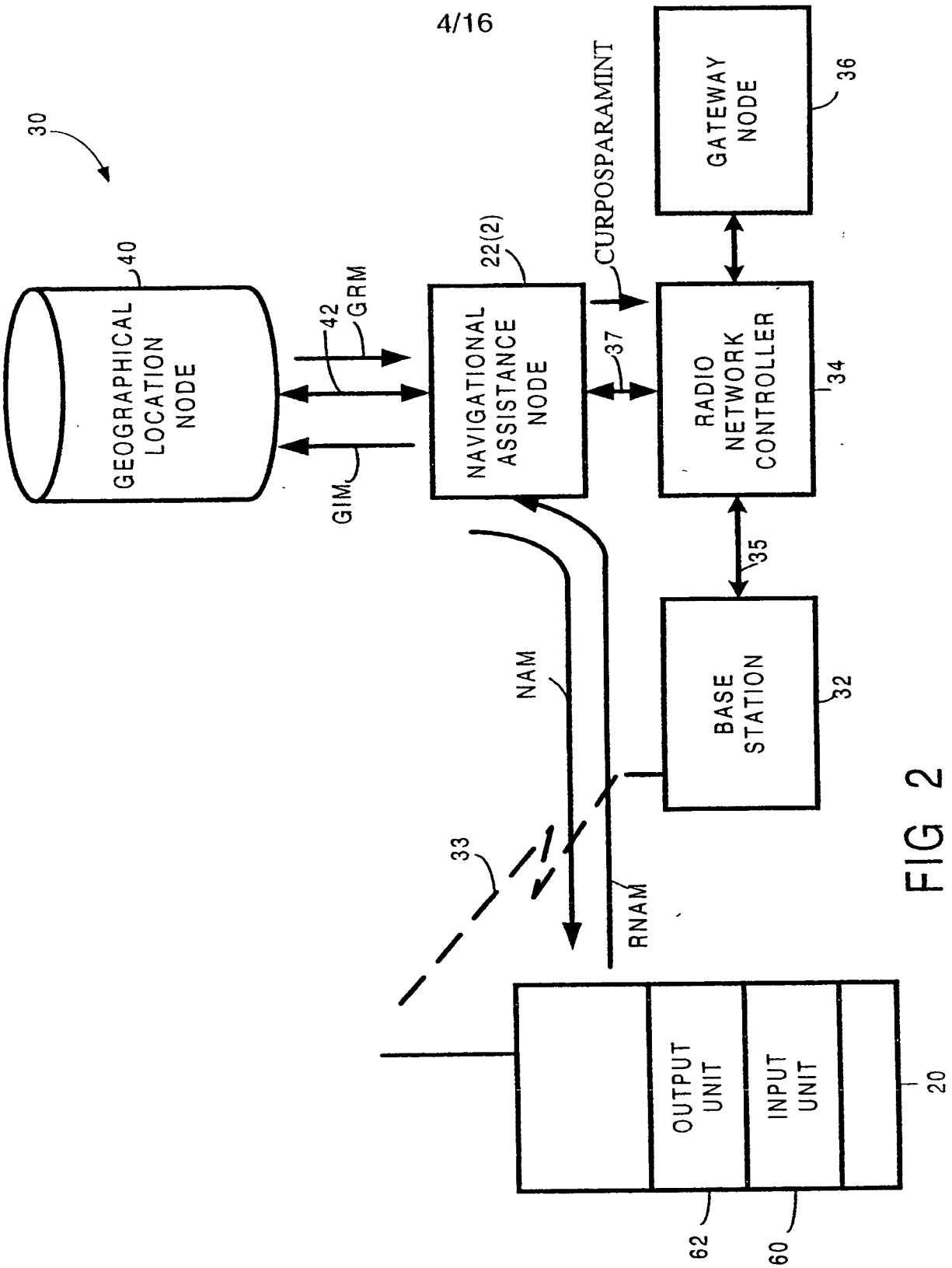

30
GEOGRAPHICAL LOCATION NODE
40
42
GRM
GIM
NAVIGATIONAL ASSISTANCE NODE
22(2)
CURPOSPARAMINT
GATEWAY NODE
36
RADIO NETWORK CONTROLLER
34
37
35
BASE STATION
32
NAM
RNAM
33
OUTPUT UNIT
INPUT UNIT
20
62
60

FIG 2

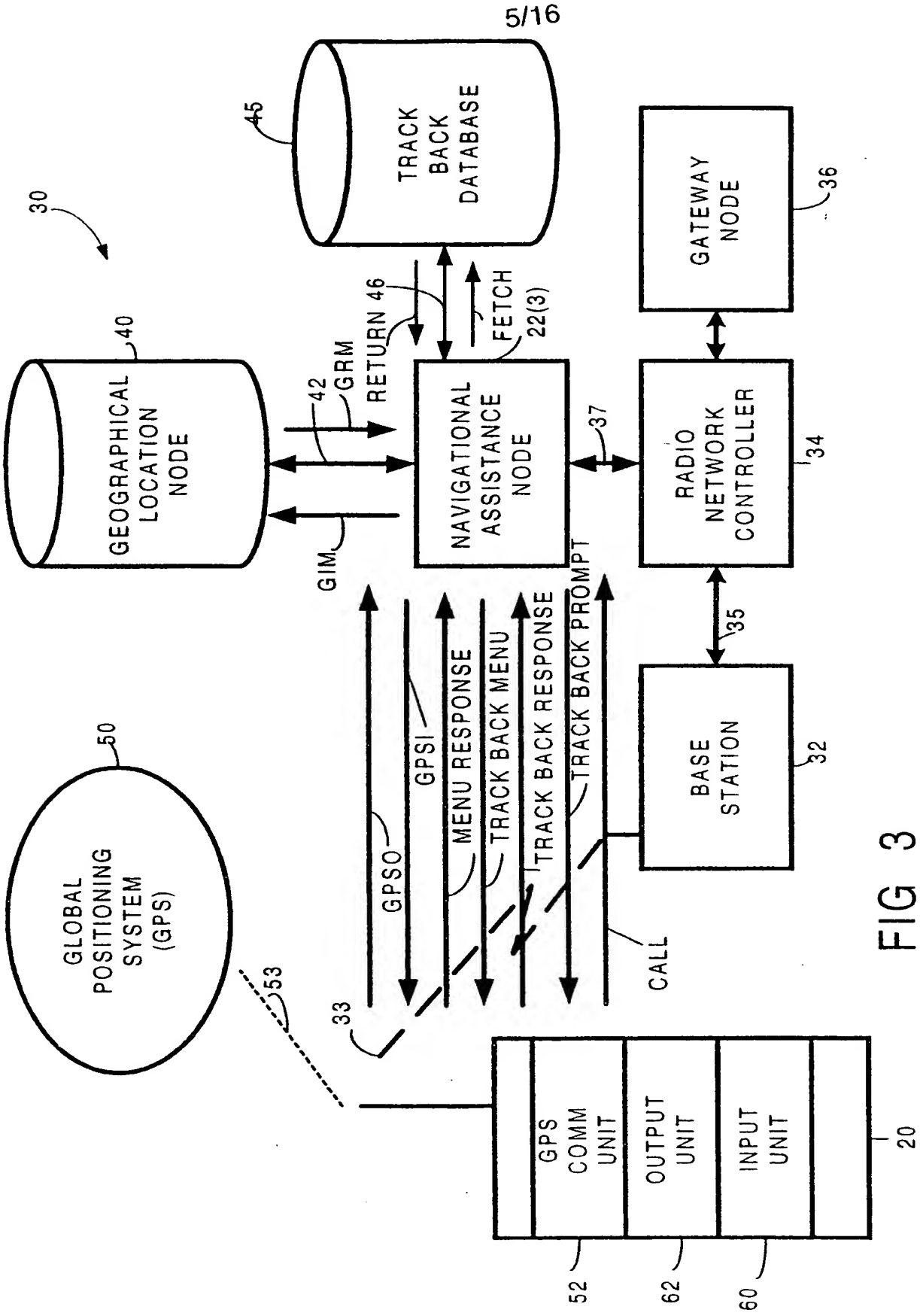

30
45
TRACK BACK DATABASE
GATEWAY NODE
36
40
GEOGRAPHICAL LOCATION NODE
42
GRM
RETURN 46
FETCH 22(3)
NAVIGATIONAL ASSISTANCE NODE
37
RADIO NETWORK CONTROLLER
34
GIM
GPSO
GPSI
MENU RESPONSE
TRACK BACK MENU
TRACK BACK RESPONSE
TRACK BACK PROMPT
35
BASE STATION
32
50
GLOBAL POSITIONING SYSTEM (GPS)
53
CALL
33
GPS COMM UNIT
OUTPUT UNIT
INPUT UNIT
20
52
62
60

FIG 3

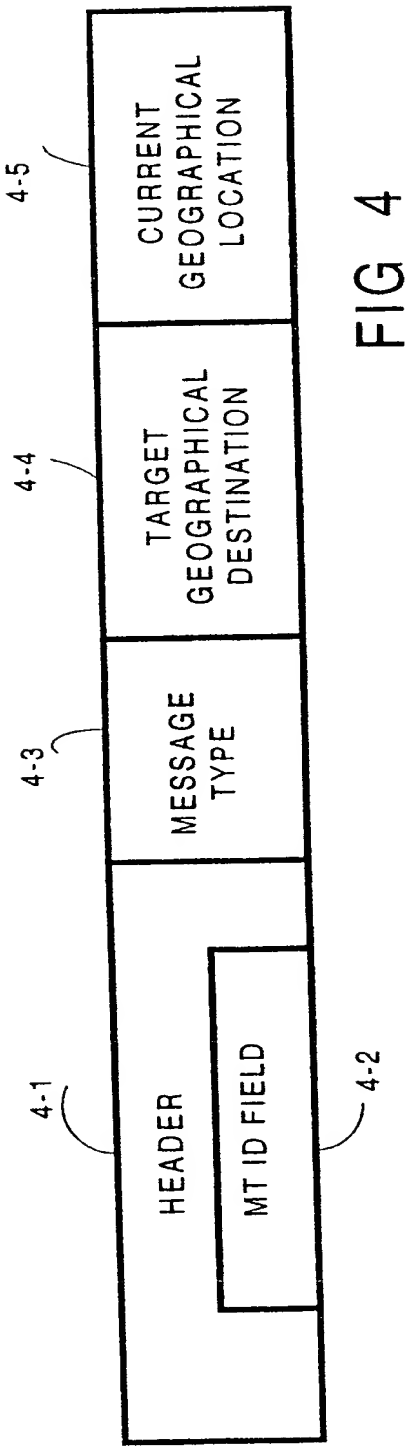

HEADER
MT ID FIELD
MESSAGE TYPE
TARGET GEOGRAPHICAL DESTINATION
CURRENT GEOGRAPHICAL LOCATION
4-1
4-2
4-3
4-4
4-5

FIG 4

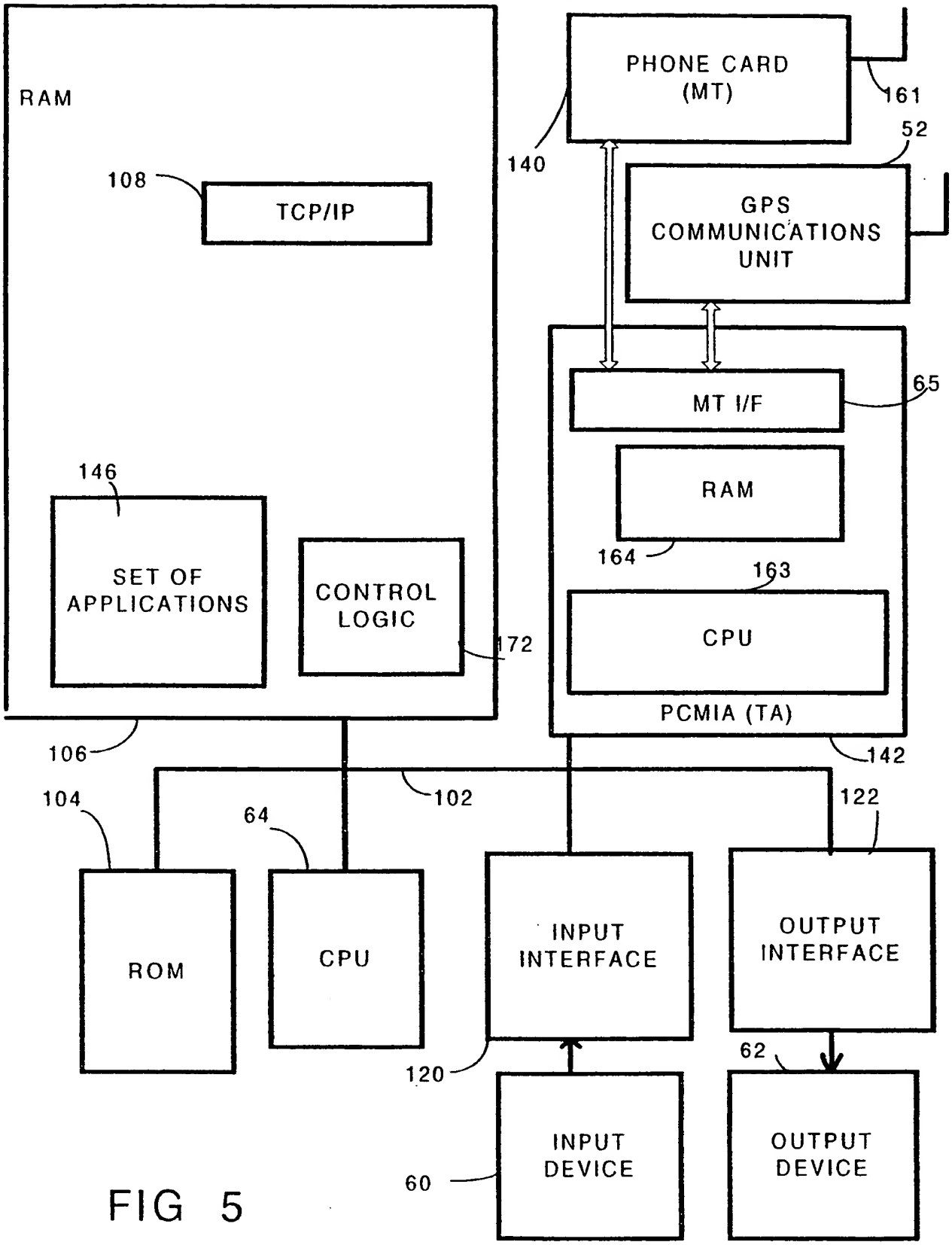



FIG 5

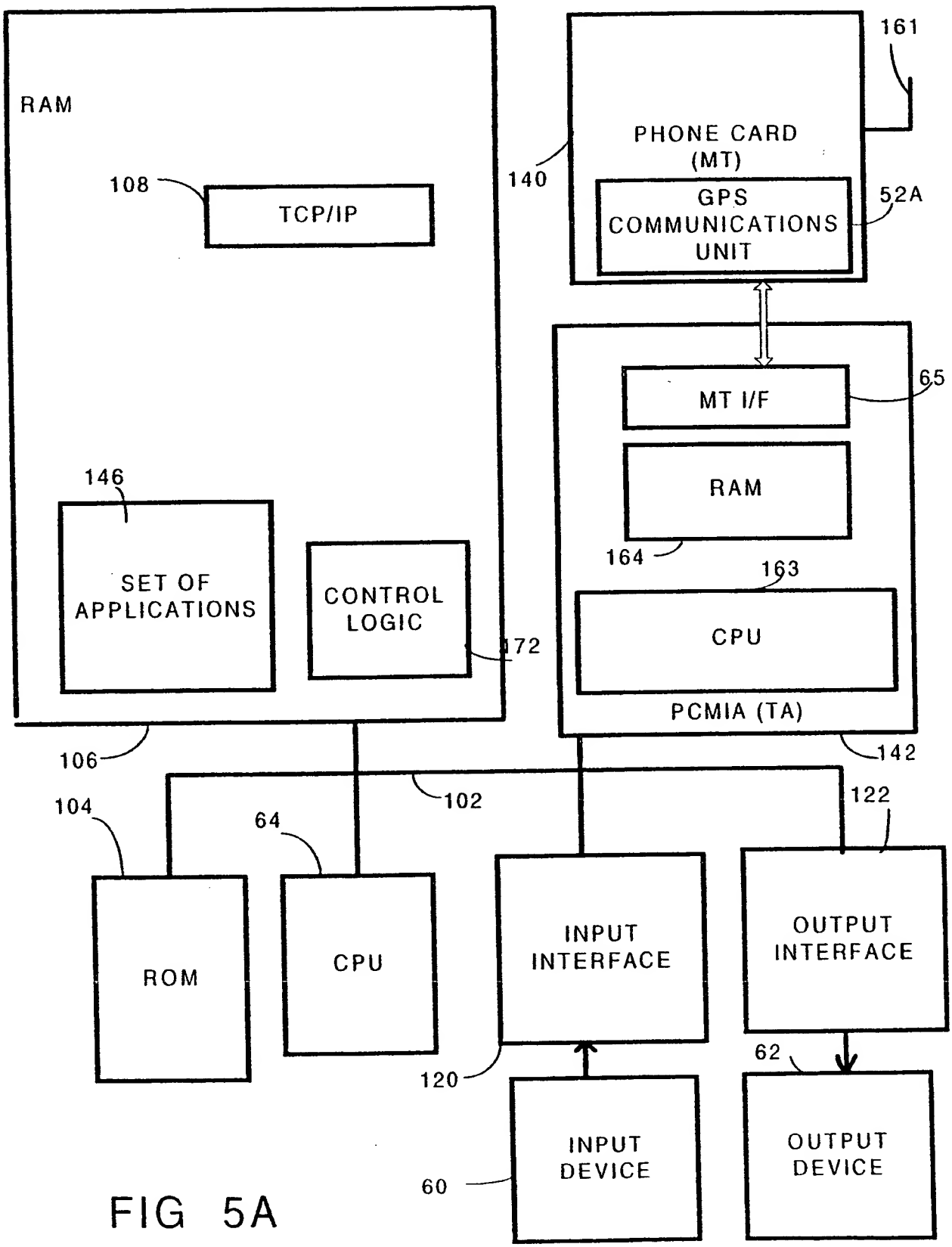

RAM
108
TCP/IP
146
SET OF APPLICATIONS
CONTROL LOGIC
172
106
104
ROM
64
CPU
102
161
PHONE CARD (MT)
140
GPS COMMUNICATIONS UNIT
52A
MT I/F
65
RAM
164
163
CPU
PCMIA (TA)
142
122
INPUT INTERFACE
120
OUTPUT INTERFACE
62
INPUT DEVICE
60
OUTPUT DEVICE

FIG 5A

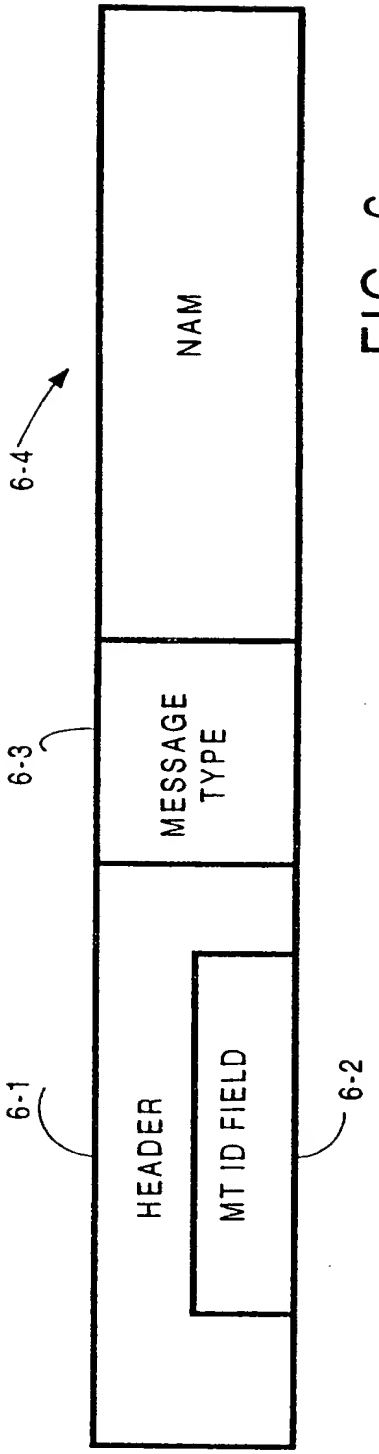



FIG 6

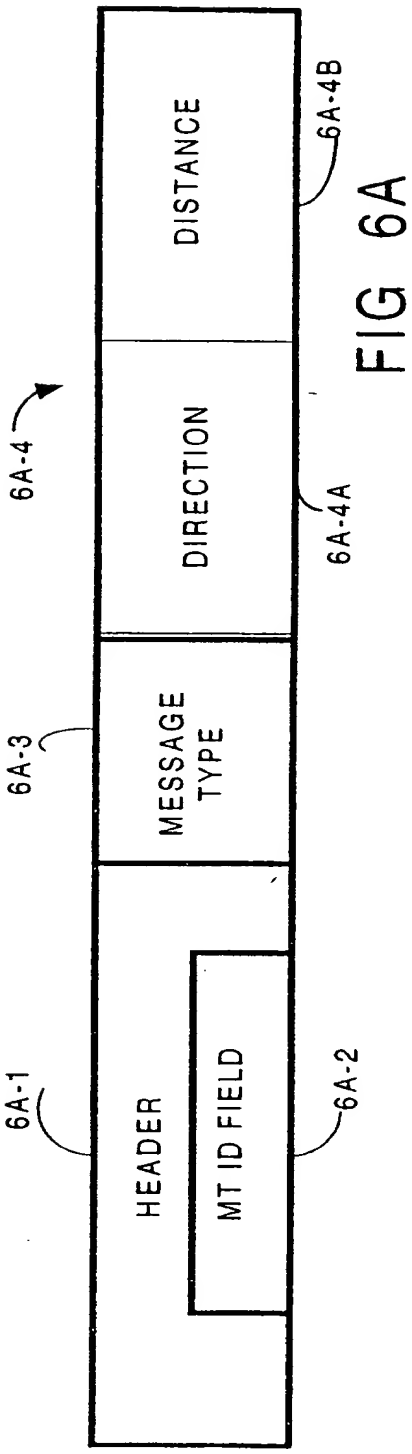



FIG 6A

FIG 7

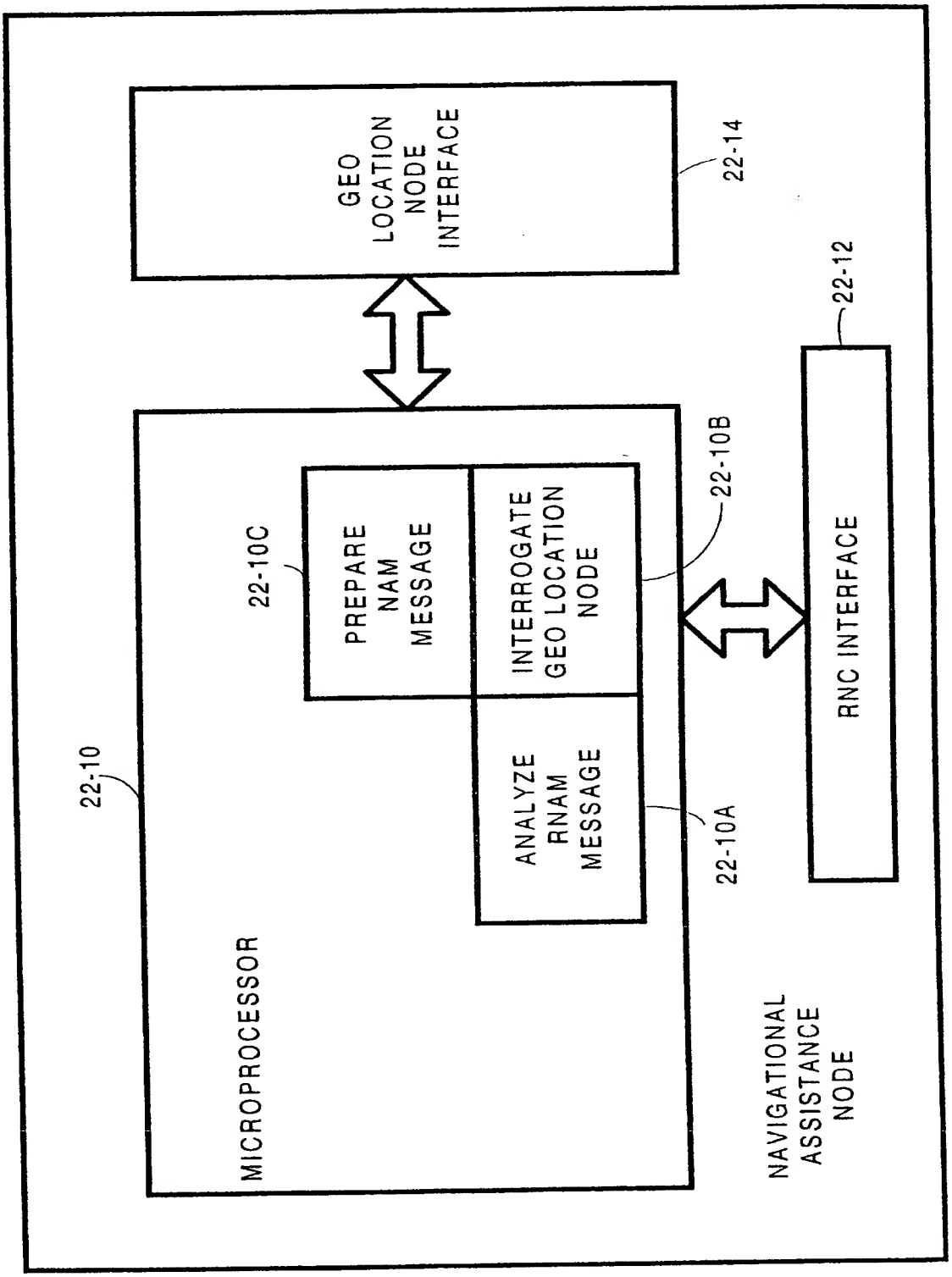

NAVIGATIONAL ASSISTANCE NODE
MICROPROCESSOR
22-10
GEO LOCATION NODE INTERFACE
22-14
RNC INTERFACE
22-12
PREPARE NAM MESSAGE
22-10C
INTERROGATE GEO LOCATION NODE
22-10B
ANALYZE RNAM MESSAGE
22-10A

FIG 7A

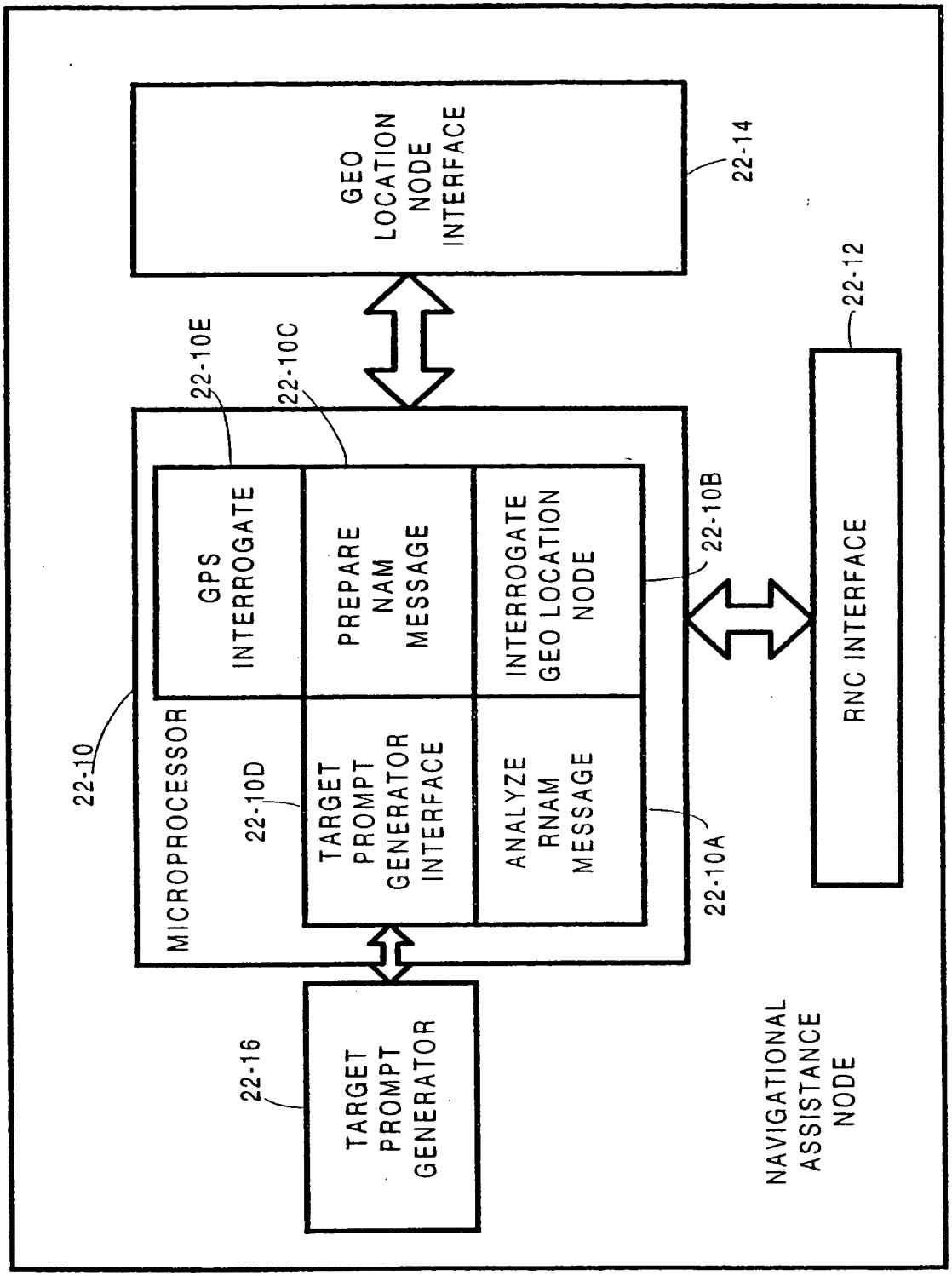


FIG 7B

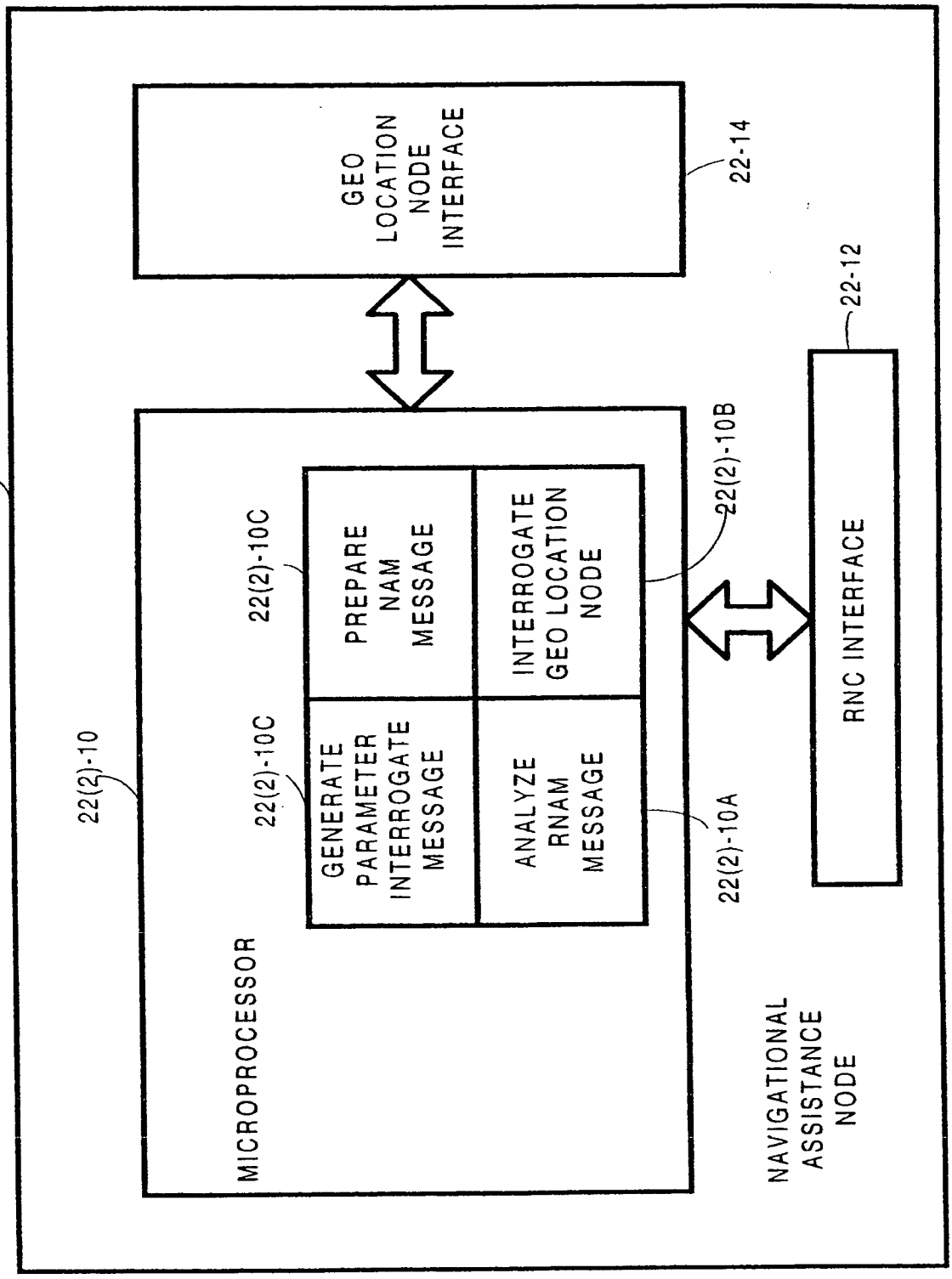
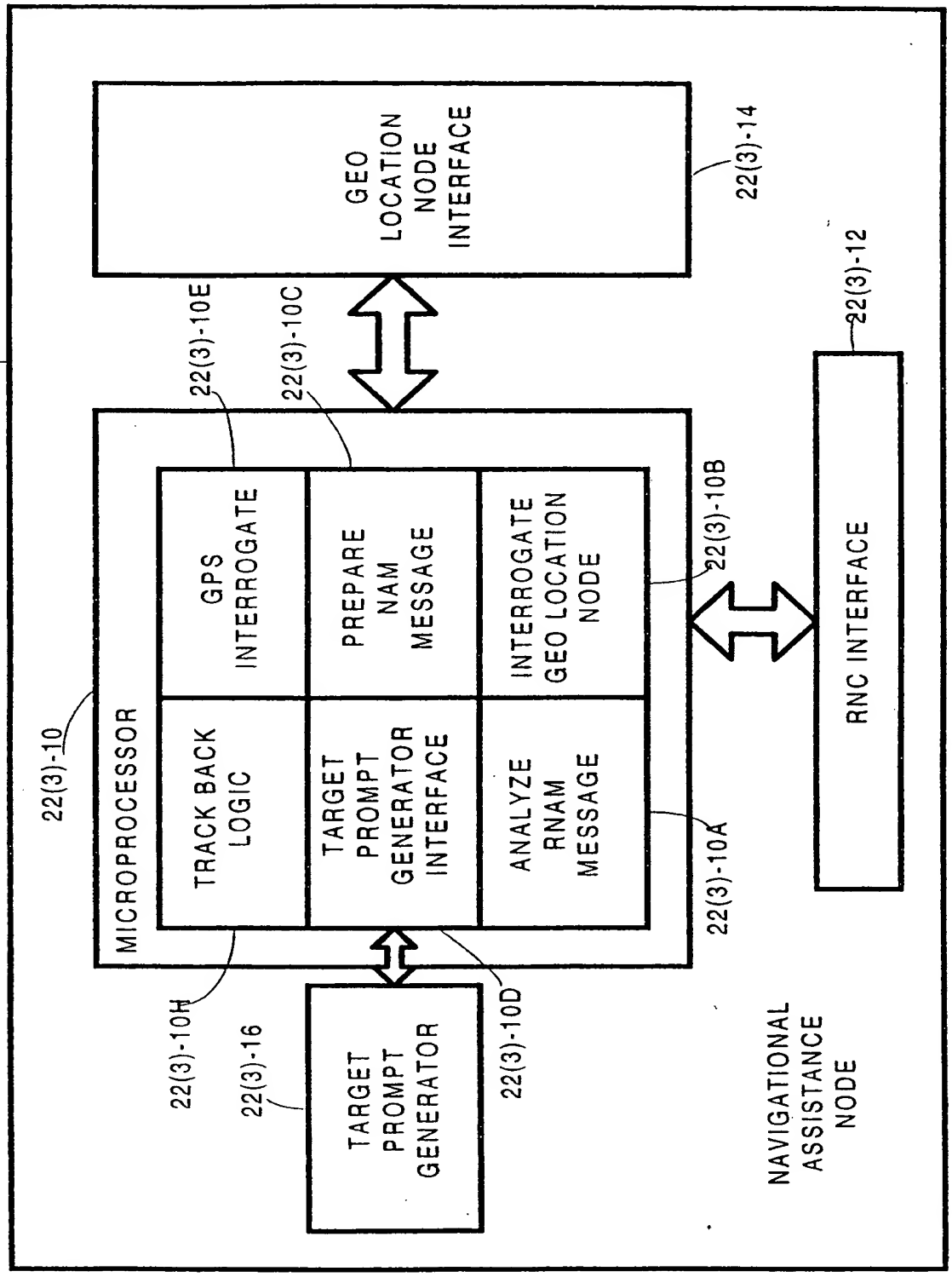


FIG 7C


22(3)
GEO LOCATION NODE INTERFACE
22(3)-14
22(3)-12
22(3)-10E
22(3)-10C
22(3)-10B
RNC INTERFACE
MICROPROCESSOR
22(3)-10
GPS INTERROGATE
PREPARE NAM MESSAGE
INTERROGATE GEO LOCATION NODE
TRACK BACK LOGIC
TARGET PROMPT GENERATOR INTERFACE
ANALYZE RNAM MESSAGE
22(3)-10A
22(3)-10H
22(3)-16
22(3)-10D
TARGET PROMPT GENERATOR
NAVIGATIONAL ASSISTANCE NODE

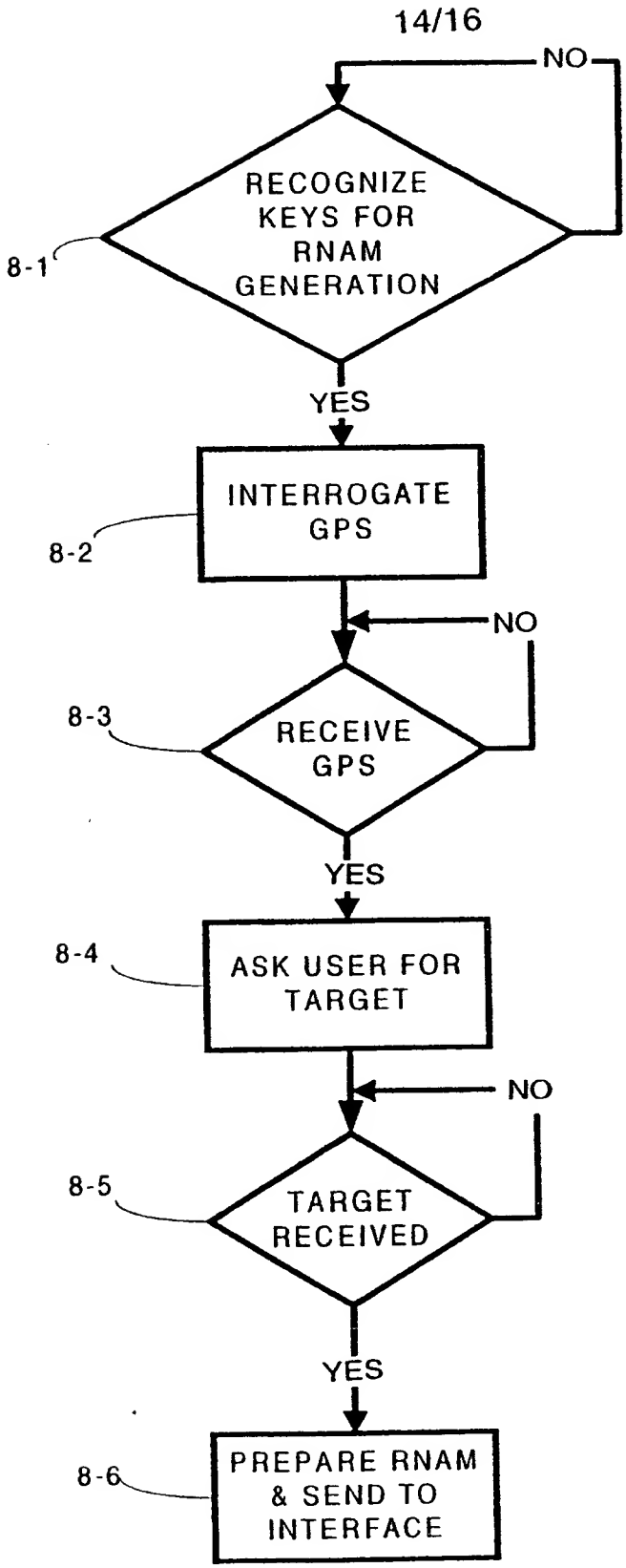

NO
RECOGNIZE KEYS FOR RNAM GENERATION
8-1
YES
INTERROGATE GPS
8-2
NO
8-3
RECEIVE GPS
YES
8-4
ASK USER FOR TARGET
NO
8-5
TARGET RECEIVED
YES
8-6
PREPARE RNAM & SEND TO INTERFACE

FIG 8

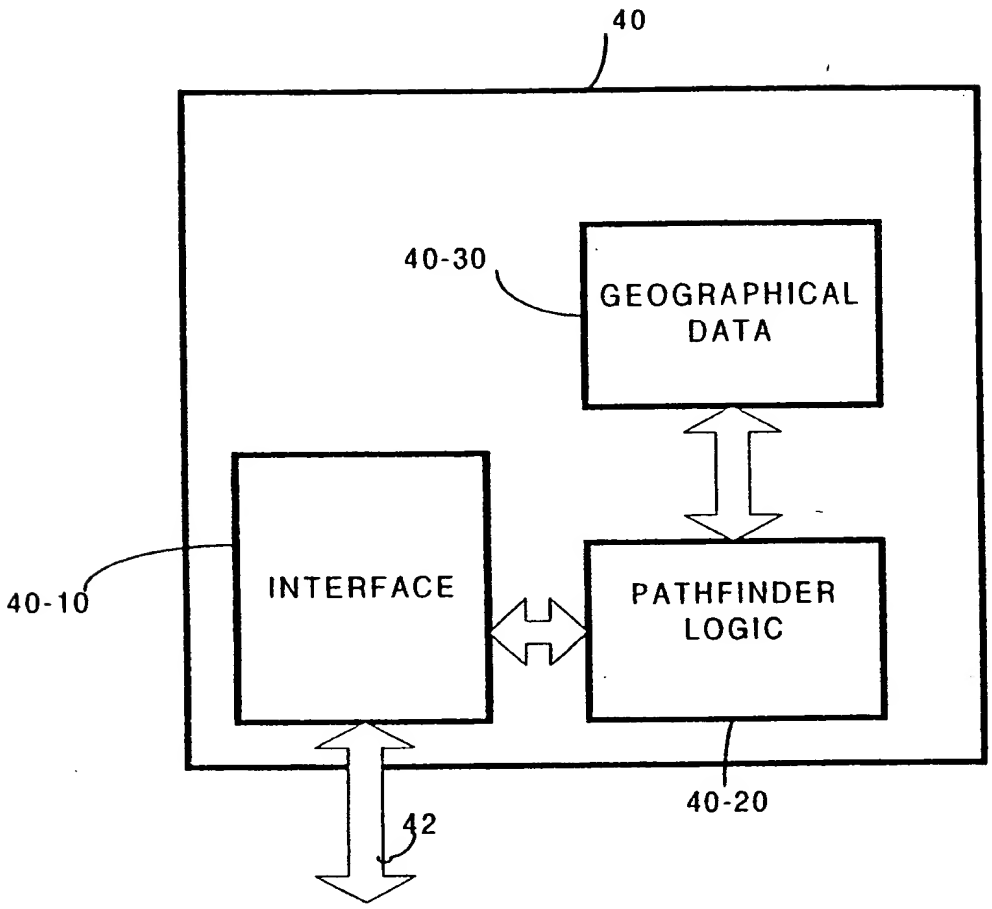

40
40-30
GEOGRAPHICAL DATA
INTERFACE
40-10
PATHFINDER LOGIC
40-20
42

FIG 9

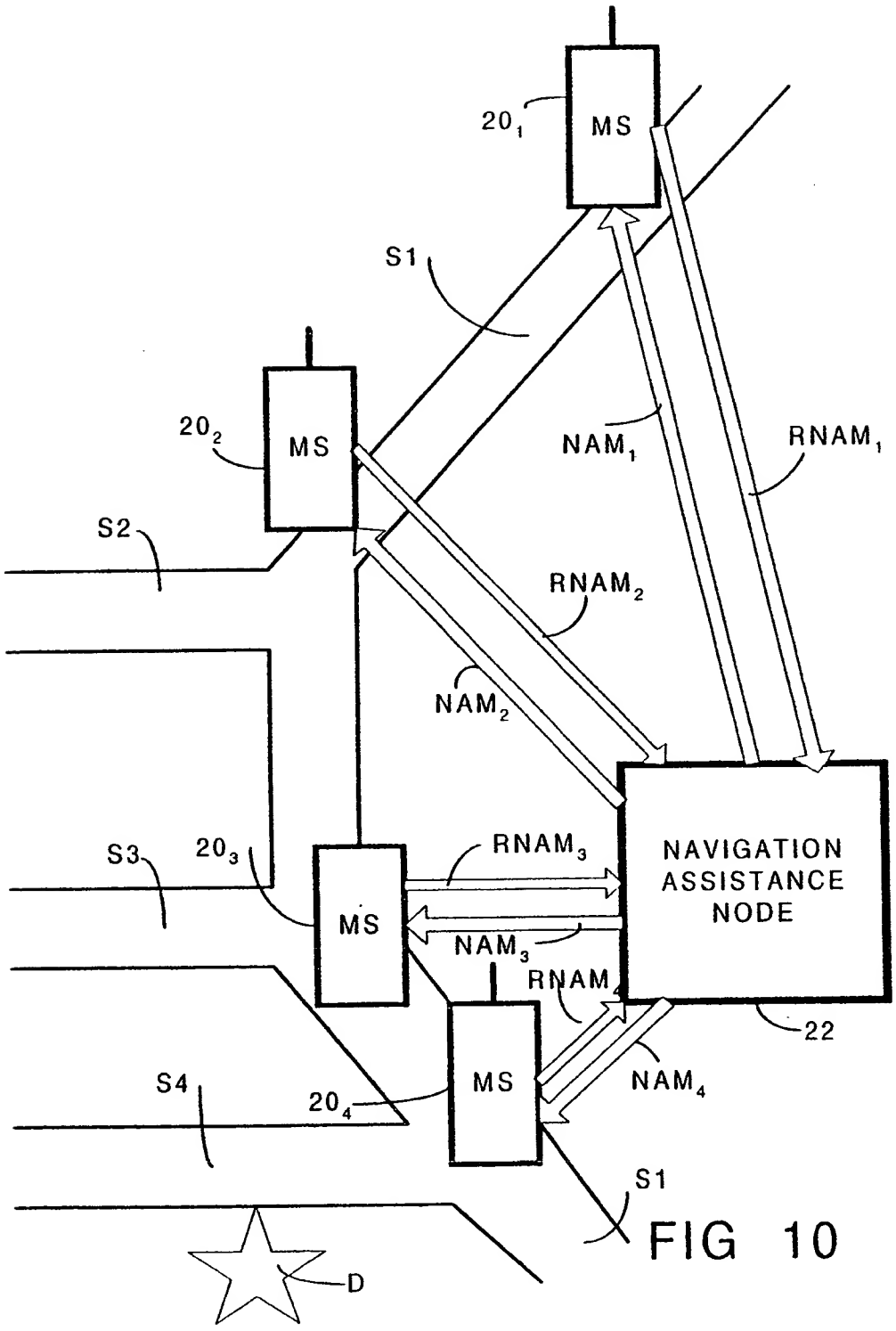

$20_1$
MS
S1
$20_2$
MS
$NAM_1$
$RNAM_1$
S2
$RNAM_2$
$NAM_2$
NAVIGATION ASSISTANCE NODE
S3
$20_3$
MS
$RNAM_3$
$NAM_3$
$RNAM_4$
22
S4
$20_4$
MS
$NAM_4$
S1
D

FIG 10

# INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/SE 99/01427

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01S5/14 G01S5/00 G08G1/127 G08G1/0968

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01S G08G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | WO 96 07110 A (MANNINGS ROBIN THOMAS ;BRITISH TELECOMM (GB); WALL NIGEL DAVID CHA) 7 March 1996 (1996-03-07) | 1-4,6-9, 15-17, 20-23, 25-28, 33-35 |
| Y | page 18, line 9 - line 15<br>page 3, line 15 - line 21<br>page 5, line 17 - line 20<br>page 9, line 5 - line 16<br>page 10, line 25 - line 30; figure 1<br>page 11, line 33 -page 12, line 1<br>page 12, line 14 - line 17<br>page 12, line 25 - line 30<br>page 15, line 2 | 5,10-13, 19,24, 29,31,37 |

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[X] Further documents are listed in the continuation of box C. [X] Patent family members are listed in annex.

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| 21 December 1999 | 11/01/2000 |

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| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016 | Niemeijer, R |

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